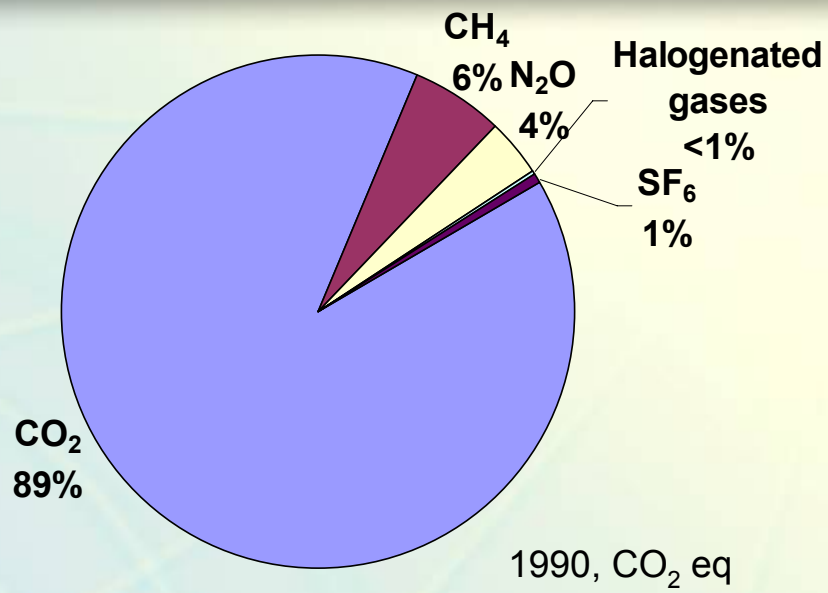
AB 32: The California Global Warming Solutions Act of 2006

Overview: AB 32 Implementation Status

What Is AB 32?

- Assembly Bill 32 sets in statute 2020 target
- ARB to monitor/regulate GHG sources
- Air Resources Board lead, but:
  - Cal/EPA and Climate Action Team continue coordinating statewide climate policy
  - Other agency authorities preserved

California GHG Emissions



CO_2, N_2O | CO_2, CH_4, N_2O | CO_2 | CO_2 | HFCs

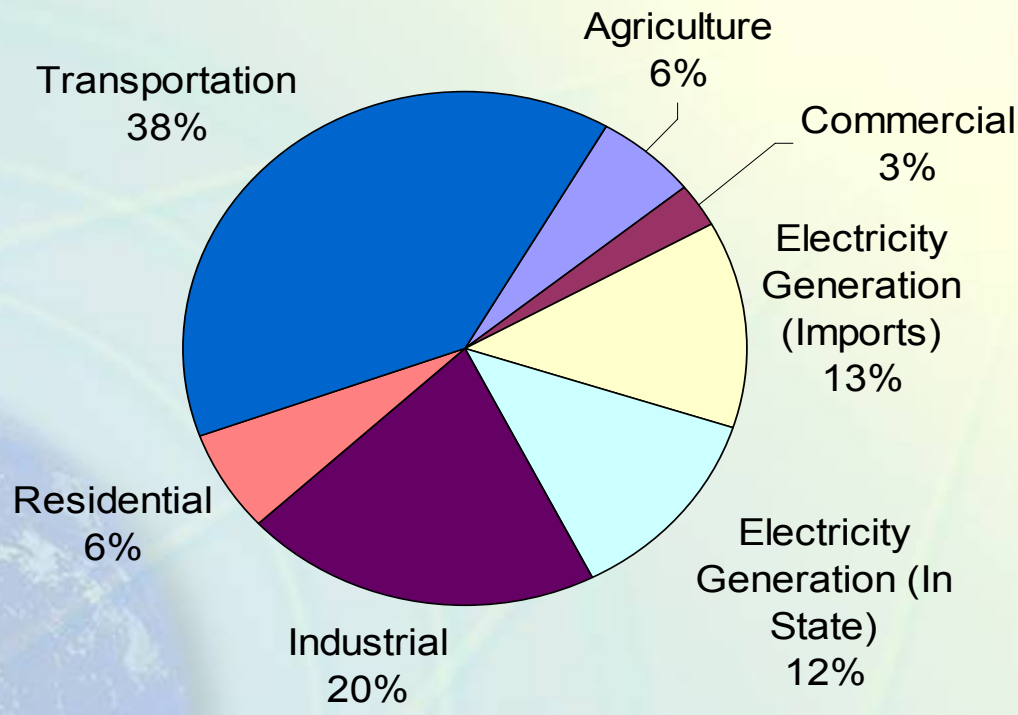
ARB, "California 1990 Greenhouse Gas Emissions Level and 2020 Emissions Limit" (2007), www.arb.ca.gov/cc/ccei/inventory/1990_level.htm

Sectors

- Agriculture
- Forests
- Business/Industry
  - Cement
  - Semiconductor Manufacturing
  - Oil and Gas/Refining
  - General Combustion
- Energy (Electricity/Natural Gas)
- Water
- Transportation
  - Land Use/VMT
  - Vehicles
  - Fuels
- High GWP Gases
- Recycling and Waste Management
- State Gov't
  - Green buildings
  - State fleet

California GHG Emissions

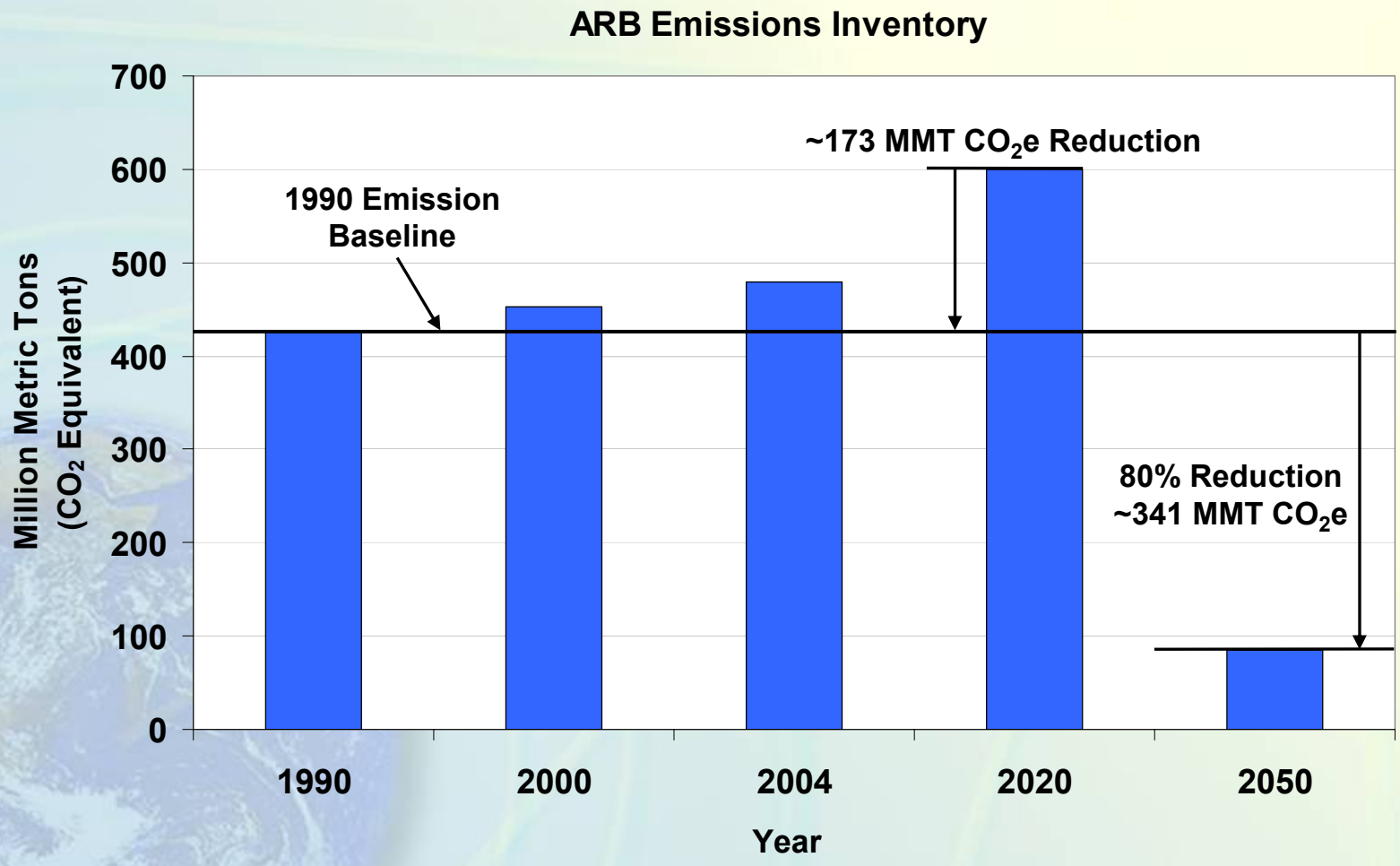
2004 Emissions (480 MMT CO_2E)



(Cement Sector approximately 9% of Industrial emissions)

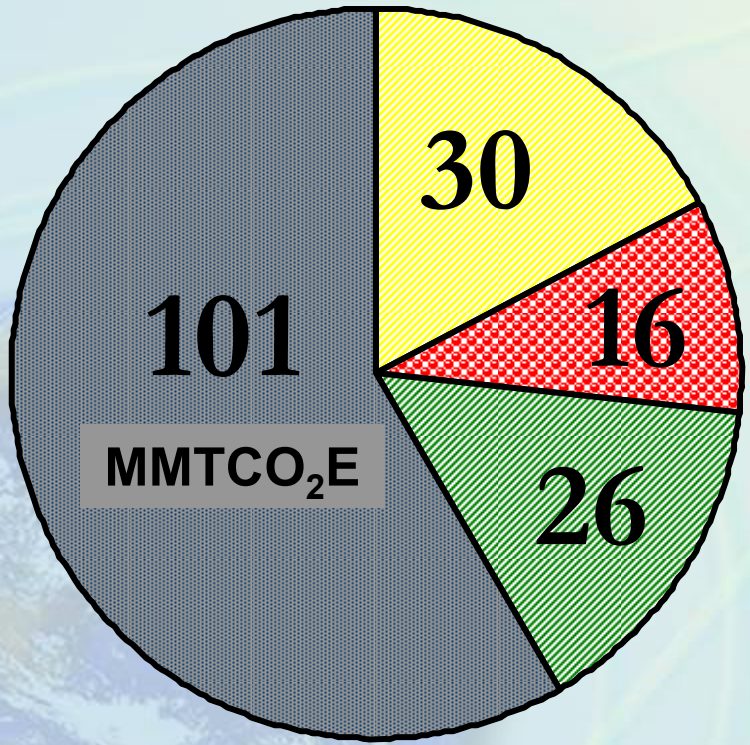
ARB, "California 1990 Greenhouse Gas Emissions Level and 2020 Emissions Limit" (2007), www.arb.ca.gov/cc/ccei/inventory/1990_level.htm

Magnitude of the Challenge



ARB 2020 Emission Reductions
A Significant Fraction of the 2020 Target

(AT LEAST 72 of 173 $MMTCO_2E$)



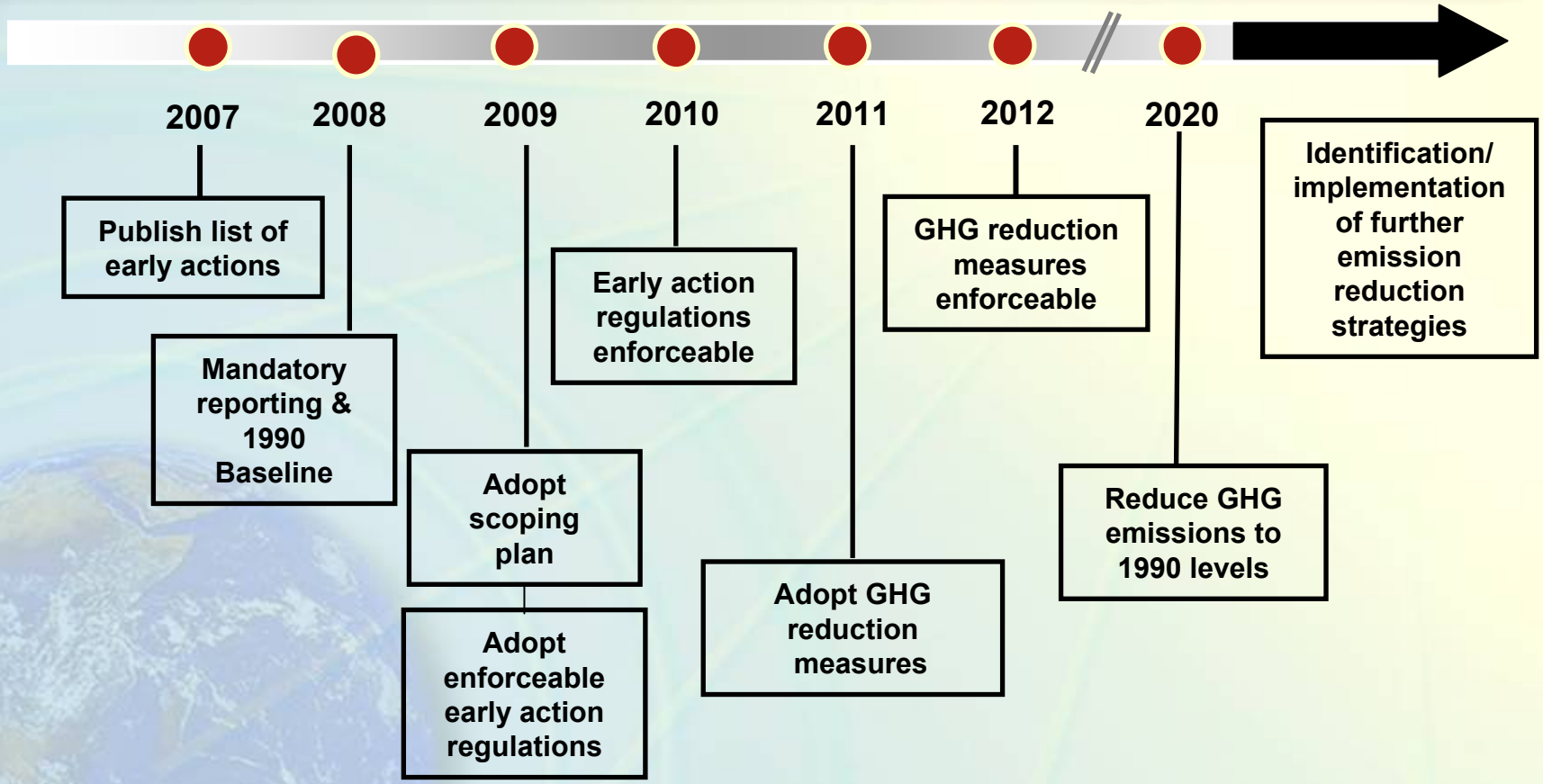
- Adopted Strategies (AB 1493, Anti-Idling)
- Discrete Early Action Measures
- Other Early Actions
- Remaining Reductions (scoping plan, CAT)

Pathways to Reducing GHG Emissions

- Regulatory
  - Alternative Compliance Mechanisms
- Market-Based Mechanisms
  - Cap & trade
  - Offsets
- Other Alternative Mechanisms Incentives

  (e.g., voluntary actions, carbon fees, Incentives, etc.)

AB 32 Timeline



Scoping Plan Development

What Is the Scoping Plan?

- Describe how California will reduce GHG emission levels to 1990 levels by 2020
- Provide vision for low carbon future – 2050+
- Establish California's leadership on addressing climate change
- Maximize benefits to California
  - Criteria and toxic air pollutant co-benefits
  - Economic development (green technologies)

How Will the Scoping Plan Be Developed?

- Identify maximum technologically feasible and cost-effective measures
- Assess possible mechanisms to achieve reductions
- Evaluate scenarios to achieve the 2020 limit
- ARB staff responsible for the Scoping Plan
  - ARB working closely with Cal/EPA and Climate Action Team Subgroups

Tentative Scoping Plan Development Schedule

Nov 30, 2007	✓Scoping Plan Kick-Off Workshop
Dec 6 & 7, 2007	✓ Board Hearing - 1990 Baseline, Mandatory Reporting
Dec 14, 2007	✓Sector Summary Workshop
Jan 16, 2008	✓Mechanisms Workshop
May 5, 2008	Scoping Plan Scenarios Workshop (Sac)
June 26, 2008	Draft Scoping Plan released
July 2008	Workshops on draft plan (Statewide)
Oct 2008	Final Staff Proposal released
Nov 20-21, 2008	Board Hearing - Scoping Plan

Getting to 2050

- Scoping Plan must meet 2020 requirement
  - Also should address longer-term 2050 goal
- Scoping Plan measures should contribute to 2050 goal
- Some Scoping Plan strategies may have greater impacts after 2020

Contacts

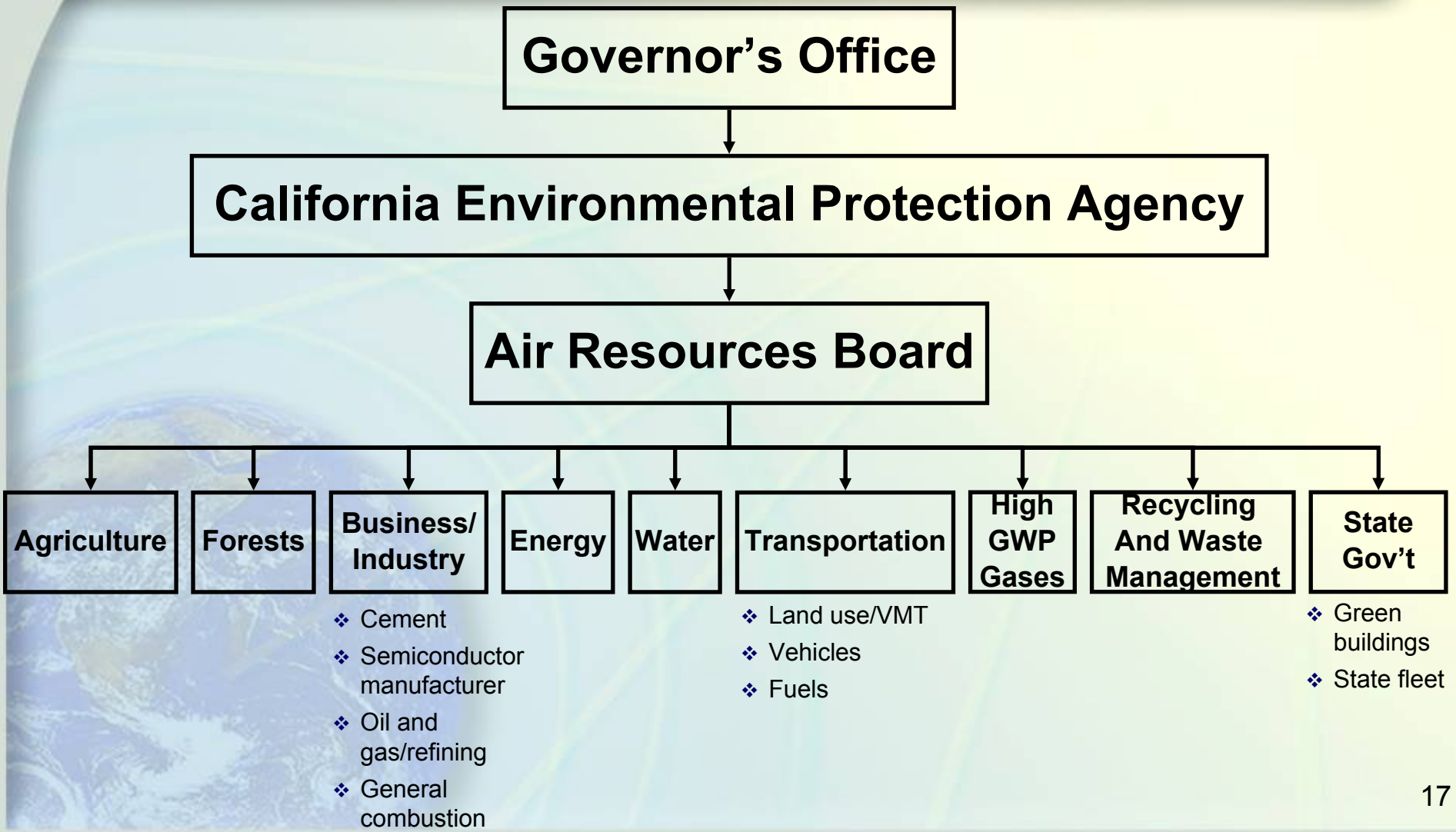
- Bruce Tuter
  - (916) 324-5932
  - btuter@arb.ca.gov
- Climate Change website
  - www.arb.ca.gov/cc/cc.htm
- Program Design workshop
  - www.arb.ca.gov/cc/scopingplan/pgmdesign-sp/meetings/2008_Meeting_Schedule.pdf

Industry Background and Overview

By Tom Pyle, P.E.

CAT Cement Sub-Group Leader

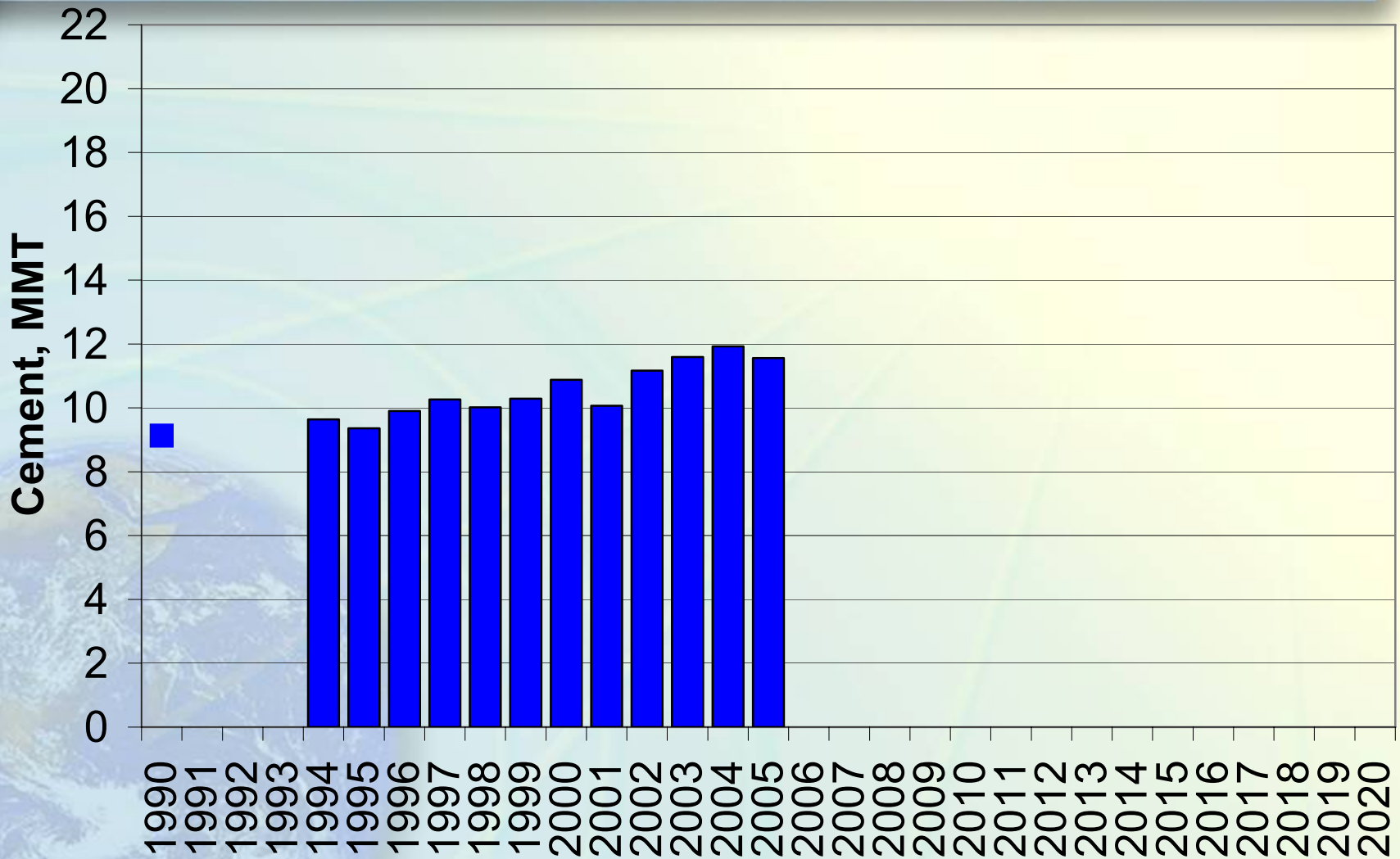
CAT relation with the Governor, Cal/EPA and ARB



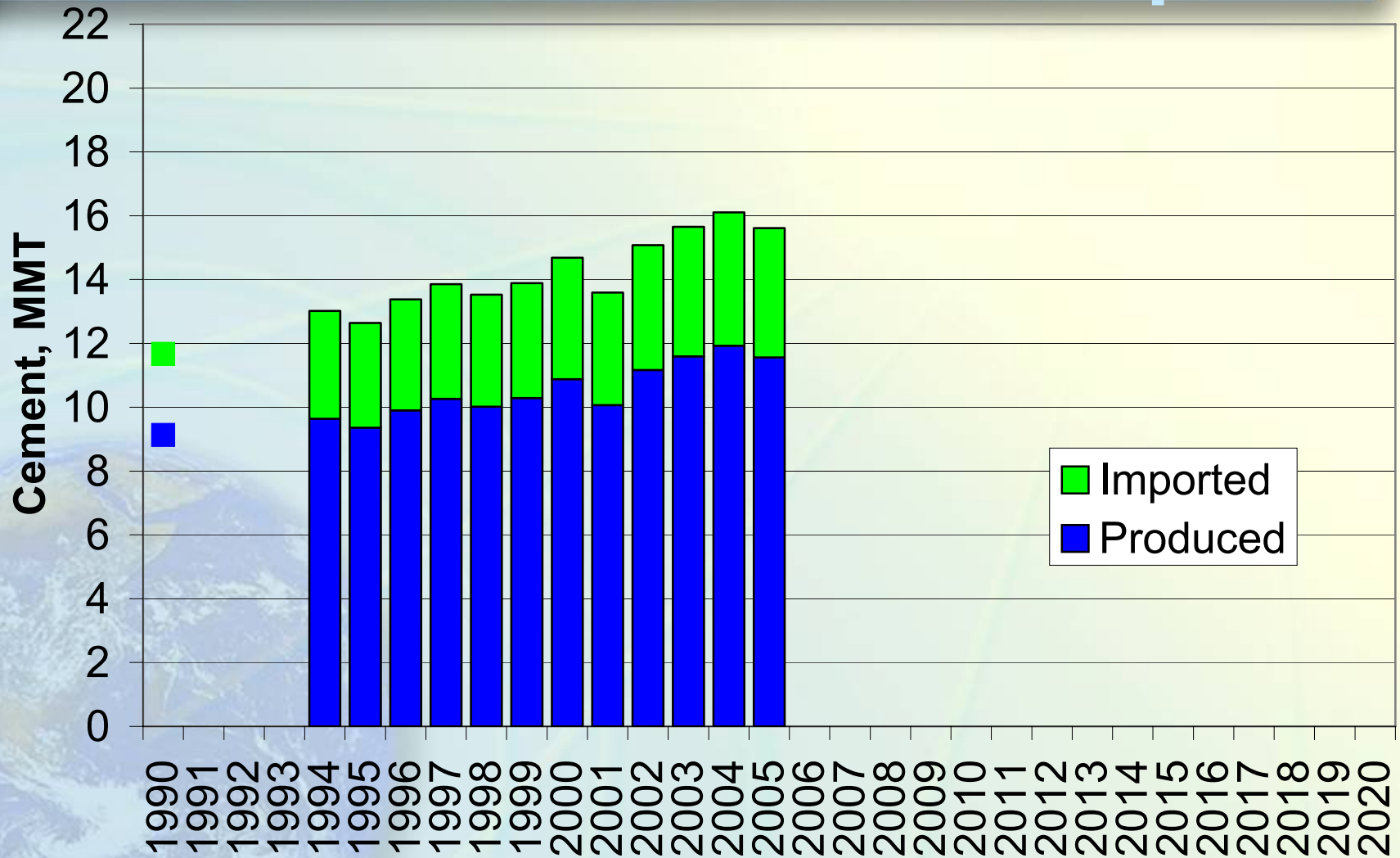
What is the CAT thinking about?

- Where can we save GHG?
- How much will it cost?
- Is the cost a burden to the industry?
- Will strategies for GHG reduction cause inflation?
- What other benefits are there from the strategies?
- Can the market withstand the changes?
- What are the effects on the environment?
- Do the strategies require new technology?
- What are the effects on the quality of the cement and concrete?

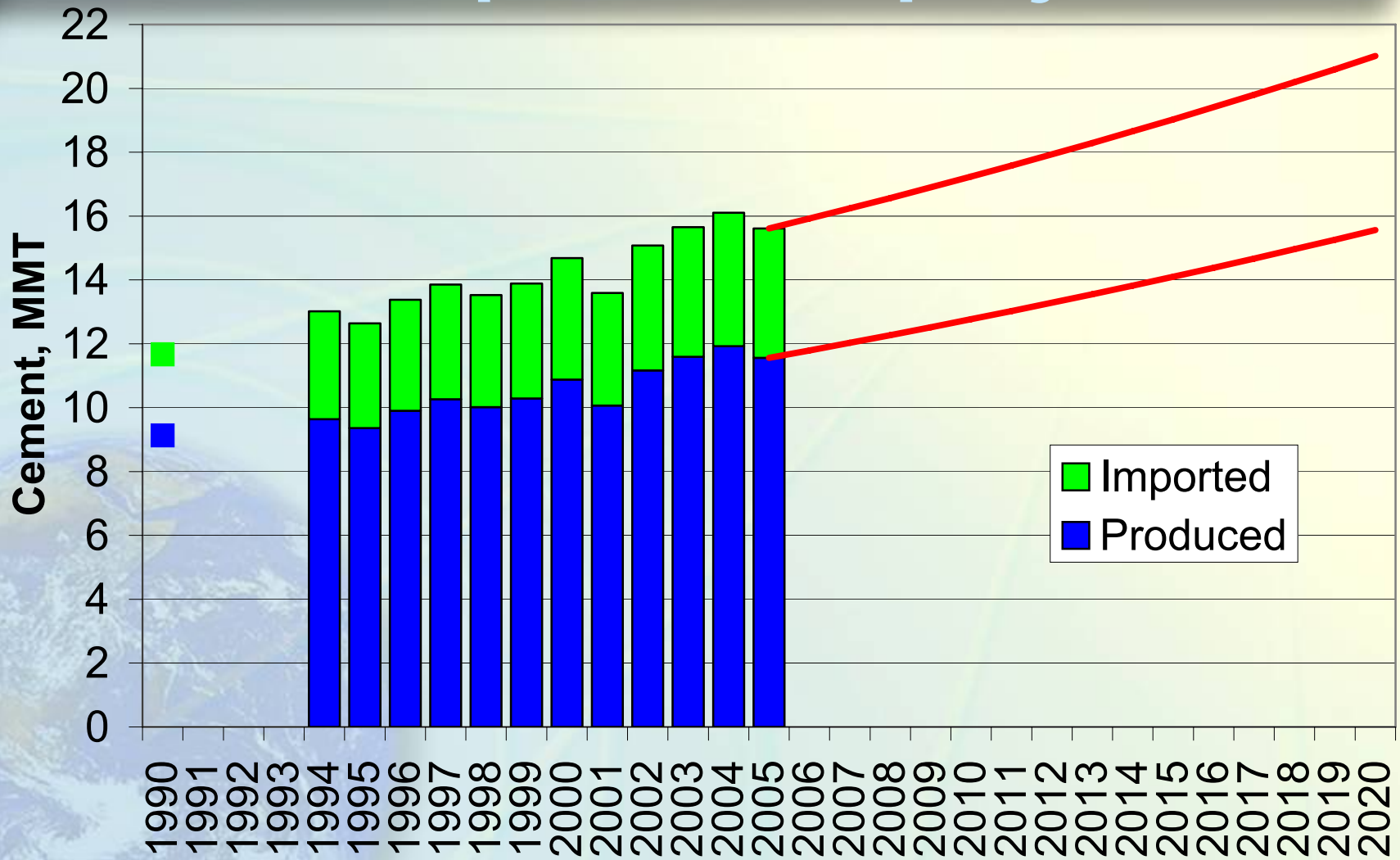
California cement production



California cement production and imports



California cement production, imports and projections



Cement production GHG sources

- Main type:
  - Carbon dioxide(CO_2)
- Other types:
  - Methane (CH_4)
  - Nitrous oxide (N_2O)

What is GHG intensity factor?

- Ratio between the amount of GHG and the corresponding amount of cementitious materials (CM).
- Comprised of three main components:
  - Calcination
  - Fuel combustion
  - Shipping

Calcination

- Limestone is $CaCO_3$
- Chemical process
  - $CaCO_3$ + heat $\rightarrow$ CaO + CO_2
- Intensity
  - **1990:** **0.52** tons of CO_2 per ton of CM*
  - **2005:** **0.52** tons of CO_2 per ton of CM*

Note. CM=cementitious materials

Fuel combustion

- Fuel → energy → clinker
- Intensity
  - **1990: 0.40** tons of CO_2 per ton of CM*
  - **2005: 0.34** tons of CO_2 per ton of CM*

Note. CM=cementitious materials

Source: Portland Cement Association (2007).

Shipping

Concrete waste

- 5-8% returns

Concrete intensity report

GHG source	Tons	CO_2 reduction
Concrete	3,500	-
Cementitious	1,000	-
Cement	700	-
Fly ash	200	-
Slag	100	-
Fly ash replacement	-	20%
Slag replacement	-	10%
Total replacement	-	30%

Cement intensity report

GHG source	Tons of CO_2 per ton of cement	Intensity
Calcination	0.52	0.52
Fuel/energy	0.40	0.40
Limestone	0.00	-0.03
Fly ash / slag	0.00	-0.09

What WILL this sector do?

- Create an intensity
  - Cement
  - Concrete
- Allow for flexibility
- Look for incentives
- Create a reporting system

What WON'T this sector do?

- Prescribe mixes for applications
- Tell you how to make PCC
- Tell you what SCMs to use
- Tell you how to manage your business

Cement Manufacturing in California

General Information

- **11 cement plants in CA**
  - **3 in Northern CA**
  - **8 in Southern CA**
  - **Over 1,700 employees**
  - **14 cement kilns in CA**

General Information

- **Cement Plant Process**
  - **11.3 MMT Clinker**
  - **11.6 MMT Cement**
  - **Average limestone addition: 2.1%**
  - **2 plants blend SCMs**

General Information

- **Equipment Used**
  - 9 plants have preheater/precalciner
  - Grinding (Raw and Finish):
    75% ball mills; 25% roller mills
  - Majority of plants have separators
  - All plants have computer control rooms

General Information

- **Operation and Maintenance**
  - **All plants have O&M plans**
  - **All plants have kiln heat loss detection**
  - **Refractory bricks replaced annually**
  - **Kiln seal replaced 6 months to 2 years**
  - **Routine inspections and repairs**

Cement Imports

- Over 40% cement is imported into CA
- Majority imported from China
  - 60% vertical kilns in China
- 25% increase in CO_2 emissions from shipping

Concrete Batch Plants

- Over 400 - 500 established concrete batch plants in CA
- Many more temporary batch plants
- 75% of cement distributed to concrete batch plants
- 25% distributed to other businesses

Fuels

- **2006 Fuel Energy Output (statewide)**

Fuels	Total Energy (%)
Coal	67
Petroleum Coke	20
Natural Gas	6
Tires	5
Residual Oil	2
Biomass	< 1

Cement CO_2 Emissions

- **2006 CO_2 Emission Calculations**
  - **2006 survey data**
  - **ARB emission factors and heat content values**
- **Statewide CO_2 Emissions**
  - **Total CO_2 Emissions: 10.1 MMT**
    - → **Calcination: 5.8 MMT (57%)**
    - → **Fuels: 4.0 MMT (40%)**
    - → **Electricity: 0.3 MMT (3%)**

Energy Intensities

- **Statewide Energy Intensity Averages**
  - **Fuels (MBtu/ton clinker): 3.53**
  - **Electricity (kWh/ton cement): 132**

- **Statewide Average CIF:**

  0.87 tonne CO_2/tonne cement

Cement and Concrete Strategies

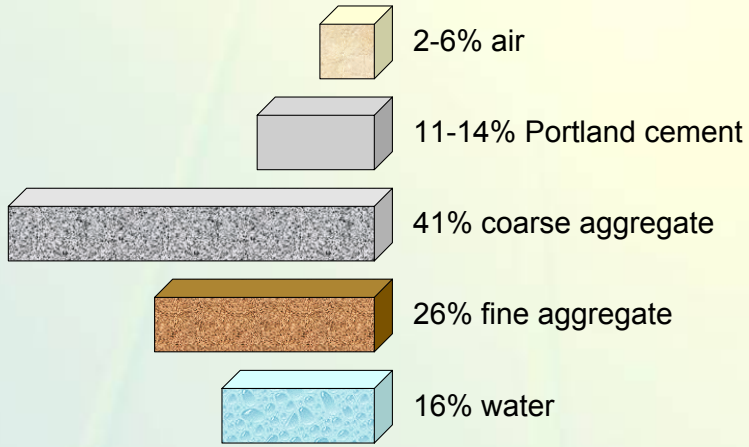
By Tom Pyle, P.E.

CAT Cement Sub-Group Leader

What are our strategies?

- **Cement:**
  - Cement GHG intensity

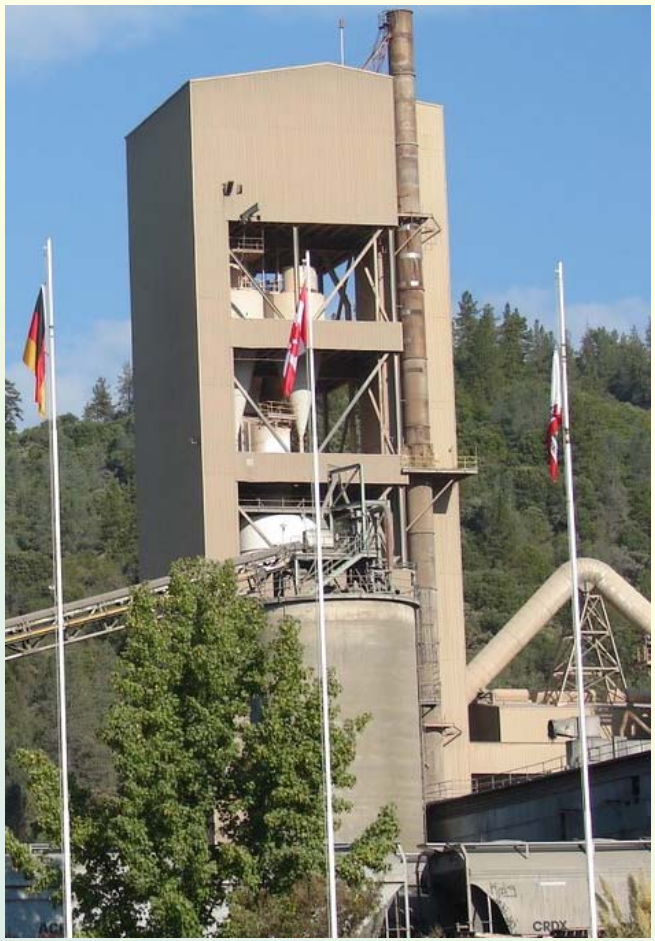
- **Concrete:**
  - Concrete GHG intensity



Cement strategy

- Production efficiency improvement
- Environmentally friendly fuels
- Use of interground limestone
- Blend SCM at cement plants

Production efficiency improvement



Environmentally friendly fuels

Use of interground limestone

Blend SCM at cement plants

Concrete strategy

- Reduce concrete waste
- Use less cement
- Universal GHG emission standard
- Blend SCM at batch plants

Reduce concrete waste

Use less cement

Universal GHG emission standard

Blend SCM at batch plants